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Measuring Displacement Effects across Gaming Products: A Study of Australian Gambling Markets.

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Abstract

This paper seeks to establish the extent of displacement effects across gaming products. This is a particularly difficult question to address with precision. To date, many studies have looked at policy changes such as the introduction of a new product into the market to assess the severity of displacement effects. However, simple before and after comparisons are invalid. One needs to know what the appropriate counterfactual would have been in the absence of the policy change - which by its very nature is unobservable. The alternative is to look at identical populations exposed to different regimes. Australia represents such a natural experiment. In Australia, Betting and Gaming legislation is determined at the state level, giving rise to some interesting differentials across states within a single country. This paper estimates a state level (fixed effects) panel data model, exploiting the intra-state differences in the portfolio of gaming products available, to estimate the extent of displacement effects across the gaming sector. The results are particularly relevant to the current UK policy debate which is focused on the potential impact on the existing market following a forthcoming, radical deregulation of the industry (with further liberalisation proposed).

Key Words: Gambling; Panel Data; Fixed Effects.
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MEASURING DISPLACEMENT EFFECTS ACROSS GAMING PRODUCTS: A STUDY OF AUSTRALIAN GAMBLING MARKETS

I. Introduction.

The market place for gaming products is an innovative environment. Increasing knowledge of players' tastes and changing technology has lead to increasing product diversity and many jurisdictions across the world have permitted or are considering legalising casinos and high prize machine gaming for the first time. This paper will examine the impact of these new forms of gaming on one particular product in the gambling sector, namely lotto. That is, we seek to establish the extent of displacement effects on lotto games from new entrants into the gaming market, utilising data from a panel of Australian states. Lotto is our focus because in many jurisdictions it has a special status in that it funds important causes, for example student scholarships in Florida and sports and arts provision in the United Kingdom.

To date, a number of studies have looked at policy changes, such as the introduction of a new product into the market, to assess the severity of displacement effects on existing gaming products. However, simple before and after comparisons are invalid. One needs to know what the appropriate counterfactual would have been in the absence of the policy change - which by its very nature is unobservable. The alternative is to look at identical populations exposed to different regimes. Australia represents such a natural experiment. In Australia, betting and gaming legislation is determined at the state level giving rise to some interesting differentials across states within a single country.

Australia provides an ideal setting within which to investigate issues relating to displacement effects given the range of different products introduced at different times by different state governments. It is clear that multiculturalism and diversity exists within Australia which makes direct policy prescriptions difficult; but this does not necessarily imply that countries cannot learn from each others' experiences - commonalities also exist which can be exploited in order to draw sensible policy recommendations. In many respects Australia is the perfect 'laboratory' for work on this topic - the complexity of gaming regulation, variation in the social acceptance of

gambling and socio-economic diversity across Australia create the necessary 'ripples' that are important for this kind of analysis. In addition, Australia has a richness of data regarding betting and gaming revenue to surpass most other countries.

The Australian case is particularly relevant to the ongoing debate on the reform of gambling law in Britain, in particular to controversy over the extent to which modern casino style gaming should be permitted. Until now, Britain's casinos have borne little similarity to the international model. They are members' clubs focussed on table games with only ten gaming machines permitted and with these limited to offering a maximum prize of only £2,000. Following the liberal recommendations in the Budd Report (DCMS, 2001), the Government introduced an only slightly less radical Gambling Bill into Parliament in 2003. This proposed that unlimited prize electronic gaming machines (EGMs) would be permitted in a new generation of 'regional', 'large' and 'small' casinos. 'Regional' casinos would have no limit on the number of devices and could offer multiple styles of gambling such as bingo and betting; 'large' casinos, defined by a minimum square footage designed to encourage their location in town centres rather than residential neighbourhoods, would also have no restraints on the number of machines; 'small' casinos were defined by a minimum space requirement and the number of machines was limited by a maximum ratio of machines to table games on offer. At this stage no limit on the number of new casinos was envisioned: the market would decide. Commentators expected several regional resort-style casinos to be built, with a network of perhaps 200 'large' venues providing more local facilities.

In the event, fierce opposition from lobbyists acting on behalf of existing gaming interests and anti-gambling organisations forced a substantial dilution of the proposals by the time the Bill became an Act in April, 2005. Only seventeen new casino licences are now authorised to be issued, one for a regional casino and eight each in the large and small categories. Further, only the single regional casino will be permitted to offer the largest pay-out (Category A) machines. This is unlikely to be the final outcome, however, since a future review of the law is proposed in light of experience of the new style casinos. Debate on the merits of providing destination resort casinos and EGMs in casinos serving more local markets is therefore ongoing in Britain.

Australia offers an equivalent to 'regional' casinos in thirteen casinos spread across the country. Further, most states permit casino-style EGMs in designated areas of 'hotels' (pubs and bars) and clubs and these often provide 100-200 machines. Such venues are roughly equivalent to the 'large' casinos in the British legislation. Crucially for our purpose, separate data are available for turnover, player losses, etc in these two sectors, labelled 'casinos and 'EGMs' in the data set available to us. Australia therefore offers the possibility of analysing the impact of both super-casinos (access to which will necessarily involve significant travel for most of the population) and a network of more local machine gaming venues. The close relevance of the Australian experience to proposals for Britain has been recognised in the debate on the link between machine gaming and problem gambling (Dodgson, Maunders and Chesters, 2004) but here we exploit it to inform the question of whether either super-casinos or a network of local EGM venues draw expenditure from state on-line lotteries.

The question is of some general interest. It is clear that in a world of budget constraints the introduction of a new product will necessarily lead to resources being diverted from the purchase of other products. Thus, as the portfolio of gambling products expands, it is interesting to ask whether the displacement comes from within the gambling sector or from elsewhere. The cannibalisation of existing products by new forms of gambling would limit the extent to which product innovation would lead to growth of gambling in total. The alternative is that product innovation here shifts resources from other sectors of the economy. So it may be the case that the observed product innovation is a result of players quickly becoming bored of games and needing constant stimulation in order that the sector can retain its revenue positions; or such innovations may be leading to actual growth of total gambling activity through external displacement effects.

2. Background and literature review.

In order to place the empirical analysis in context we will begin by providing a brief outline of the gaming sector in Australia. For a full review of gambling in Australia, see the comprehensive report by the Australian Productivity Commission (1999). We will

then proceed to review the existing literature on displacement effects within betting and gaming markets.

2.1 The Australian gaming sector.

Australians lost AU$14b (about AU$1,000 per person) in gambling activities in 2000 (Blanks, 2002) accounting for more than 1.5% of GDP. Annually 80% of Australians participate in gambling products and allocate 3.5% of their household disposable income to these activities. Lotteries have been in operation since the early 1900's and are the most popular gambling activity, with 60% of the adult population playing. Bookmaking was legalised in the 1940s when the Totalisator Agency Boards were established in most states and these are now being privatized. The 1970s and 1980s saw the introduction of new lottery games and the opening of Australia's first 'casinos'[1]. There are now 13 casinos in Australia. In several states, the 1990s saw the legalisation of 'poker machines' (EGMs); prior to this they had been available only in New South Wales (NSW).

Lotteries have a long history in Australia with the first non-profit lottery being run in Queensland in 1916 to raise revenue for war programmes. The success of such lotteries resulted in the state taking over their operation and other states introducing their own lotteries. By the 1930s lotteries and minor gaming such as charity raffles and bingo were legalised throughout Australia. There are many types of lotteries but Lotto has been the market leader in recent years. Lotto is also the most popular lottery game played around the world. Players must select a set of numbers from a choice of a larger set (without replacement) with the winning numbers being drawn randomly by the lottery operators. For example, in the basic 6/49 game, players pick six numbers from 49. It is important that these two parameters are selected carefully as they determine the probability of winning and this should be set at a level proportionate to the population size. Hence games vary across Australian states in accordance with population differences. Both government and commercial operators run Lotto games. Lotto, and

[1] In many jurisdictions, the term 'casino' is used to describe any location the main function of which is the provision of machine or table gaming. However, in Australia it is reserved for large Las Vegas- style venues and not used when referring to even large machine gaming rooms in hotels and clubs.

similar games such as Powerball, are operated both at the state level and in terms of multi-state games. Oz-lotto (drawn every Tuesday) is the national game and Saturday night lotto is operated by the Australia Lotto Bloc which includes all states (though New South Wales joined only in 2000, having previously provided a state specific game on Saturdays). Instant lotteries (or scratch cards) are also available. These are cards which players purchase and then scratch off panels to reveal whether or not they have won. They are usually priced from AU$1-10. The prizes tend to be relatively small but the probability of winning is typically better than that of other lottery products. Scratchcard data are available separately from sales figures for lotto and other on-line games.

'Poker machines' or EGMs have a long tradition in NSW (they were introduced to clubs in the 1930s) but were a more recent introduction to other states in the 1990s. Approximately 20% of the world's EGMs are located in Australia. There are currently around 185,000 in operation and half of these are located in NSW. They can be found in clubs and hotels[2] and the venues that house them generate substantial revenue from the machines. There is a large amount of policy debate in Australian regarding the issue of gaming machines. The rapid growth of this sector of the industry has caused some concern. The machines in each club and sometimes across clubs are linked to a central jackpot. Studies of gaming machine players in Victorian Casinos show that expenditures increase as the jackpot reaches its upper limit. These venues typically also offer the facilities to play keno (which is also available in casinos). In keno the odds of winning and the prizes vary according to how many numbers are chosen and matched.

Casinos have been a more recent introduction to the gaming sector with growth throughout the 1970's and 1980's- Tasmania and the Northern Territory were the first to legalise them and there is now at least one in each state (but only 13 in total exist across the country). Casinos offer a range of games, some dependent on luck and some with varying degrees of skill associated with the outcome. Payouts vary by game and are highly regulated. Due to the relatively small number of casinos in operation their

[2] In Australia bars and pubs are referred to as hotels and clubs are community based non-profit organisations.

introduction has attracted less debate relative to the rapid proliferation of EGMs in smaller local venues.

2.2 Literature Review

There have been a number of attempts to assess cannibalisation within the gambling sector (for a review, see Paton, Siegel and Vaughan Williams, 2003). Here we focus on studies that include examination of the impact of casino gaming on lotteries. Evidence is predominantly American. Anderson and Navan (1996) reported a negative relationship between state lottery revenue and riverboat gambling in six states. Anders and Siegel (1998) and Siegel and Anders (2001) focused on the impact of Indian gaming on lottery revenue in Arizona. They estimate that a 10% increase in the number of slot machines[3] in casinos located on reservations is associated with a 3.7% decline in lotto sales and thus partially accept the operator's argument that declining lottery sales can be blamed on the spread of Indian gaming. However, they caution that such a finding may not be generalisable across states, noting for example that Steinnes (1998) had found smaller impacts for Minnesota.

Recent contributions have attempted to gain more general insight by applying fixed effects analysis to annual data from panels of states. Elliott and Navan (2002) and Fink and Rork (2003) found strong displacement effects on lottery revenue from riverboat and commercial (i.e. non Tribal) casino sectors respectively. For example, Fink and Rork estimated that if casino games take an extra $5 from consumers, lottery turnover declines by $1.60. By contrast, Walker (2000) reported that in a lottery demand equation, casino revenue attracted a significant positive coefficient, implying that increases in casino gaming actually raise lottery sales, a contrast with other research findings in the US and possibly explained by a failure to account for endogeneity issues.

From the perspective of potential to inform policy formation in other countries, we are sceptical over the usefulness of the findings from studies such as these since they average out impacts over states with very different styles of casino in very different

locations. For example, in addition to Indian gaming, the rapid expansion of the US casino sector from the 1990s (documented in Eadington (1999)) took the form of openings of riverboats, racinos (at racetracks), destination resort casinos (such as at Biloxi), and facilities both in large cities (e.g. Detroit) and in depressed towns relatively remote from major population centres (e.g. former mining communities in Colorado). Thus, across states, there is great variety in the style of casino gaming offered. Different patterns of provision may have different effects which are masked by an overall average. For example, if casinos are in remote locations, visits by most individuals may be infrequent and, to the extent these visits boost the desire to gamble, other gambling media will benefit between times; but if casinos are very accessible, their net effect may be to draw funds that would otherwise be allocated to other accessible gambling opportunities like lottery tickets. Policy makers require to know what effects will follow from licencing specific types of casino. Knowledge of the relationship between an 'average' system of casinos and other modes of gambling is less valuable. In this respect, a panel data study for Australia has more potential than one for America because the data distinguish expenditure in regional super-casinos (which have territorial monopolies for their style of product offering) and expenditure in machines located in the community in venues comparable with what the British legislation terms 'large' casinos.

In this paper we will look in the Australian data for evidence of any displacement of lotto spending by EGMs. We control for displacement from other (non-gambling) leisure and entertainment activities[4].

3. Data

Data on gaming were provided by the Tasmanian Gaming Commission (2003), which, by agreement between the states, was (until recently) responsible for maintaining and

[3] Tribes are not obliged to file turnover and other financial data and the number of slots therefore had to serve as a proxy for dollar expenditure on slots.
[4] For Missouri, Siegel and Anders (1999), using county-level data, found that expansion of riverboat gaming was associated with decline in consumer expenditure on other forms of entertainment.

updating state level gambling data for Australia. We use 20 years of data (financial year 1982/83-2001/02) from the eight Australian states and territories. Other variables have been added to the model from the Australian Bureau of Statistics (ABS) Time Series Statistics Plus dataset. This contains data from approximately 20,000 published and unpublished series from over fifty ABS Main Economic Indicators and related publications. The data have been changed from nominal to real values using the Consumer Price Index (with 1976 as base year) and all variables have been converted to per capita values to account for population differences across states.

An important aspect for identification of displacement effects in our statistical modelling is the fact that there has been variation across states and through time in the types of gaming activities offered and hence Table 1 shows the dates at which the different products have been introduced to the gaming market (although a complete set of dates for all forms of gaming in all states is not available). Whilst the date for the introduction of lotto is unknown in a number of states, it was in operation for the duration of the data used in this exercise (hence we have a balanced panel). Interestingly, in Western Australia (WA) we can see that EGMs are illegal but casinos are not. That is, poker machines are allowed in very large, but not in smaller, facilities. The fact that EGMs have always been illegal outside 'casinos' (i.e. hotels and clubs do not offer machine gaming) in WA makes it an interesting 'control' state for this analysis.

The variable to be modelled is lotto turnover and Figure 1 shows the real per capita lotto turnover by state for the period considered in our data. Simply eyeballing the data, we can see that lotto sales in WA (the only state where EGMs are illegal) have seen the greatest growth over the period. NSW, which has the greatest number of EGMs, has seen stable lotto turnover; however gaming machines were introduced there long before our data begin. Victoria seems to have seen a fall in lotto turnover in the 1990s corresponding to the introduction of EGMs, but the opposite is true for the Northern Territory. However, it is difficult to extract information from this kind of univariate analysis and hence the next section will discuss the multivariate framework that will be employed to investigate potential displacement effects.

4. Statistical framework

Our data consist of yearly time series for each state and therefore represent a simple panel dataset. We want to consider the impact on lotto turnover of alternative forms of gaming and hence lotto turnover is our dependent variable. Since lotto has existed in all states for the time period under consideration, the panel is balanced. It is highly likely that there are important state characteristics to which lotto turnover is related. Indeed, turnover from the gambling industry varies immensely by state, suggesting important differences in either the social acceptability of gambling or the level of state regulation and control (which in a democracy ought to reflect the tastes of the majority of the population, albeit with the possibility of time lags) or some combination of these influences. To allow for these effects we will estimate a fixed effect model.

$$lottoT_{it} = \beta_0 + \beta_1 S_{it} + \beta_2 G_{it} + \beta_3 X_{it} + \nu_{it} \quad (1)$$

where $lotto_{it}$ is lotto turnover in state i at time t, S_{it} is a set of seven state dummy variables (Northern Territory is the reference state), G_{it} is a set of dummy variables for the different forms of gaming available in each state through time and X_{it} is a set of time varying state characteristics.

Given that our interest is in the displacement effect on lotto from the introduction of alternative forms of gaming, G_{it} consists of: other lotteries, instants, casinos, minor gaming (*e.g.* bingo), keno (a machine game with a structure similar to that of lotto) and EGMs. X_{it} consists of a mixture of variables. Unemployment is included (to try to capture aspects of the business cycle that might impact on lottery play) along with a time trend. Expenditure on tobacco and alcohol is added as a proxy for the prevalence of permissive attitudes in a state (Forrest and Gulley, 2006 show for UK households that there is strong positive correlation between expenditure on alcohol, tobacco and each of six types of gambling including lotto). Finally, spending in cafes/restaurants and hotels is included to capture potential displacement effects from the broader leisure and entertainment sector, as suggested by previous literature. It is not possible explicitly to

include expenditure on 'recreation and culture' in the model as the Australian National Accounts include gambling expenditure itself in this category and therefore it would be endogenous within our model. Including 'cafes/restaurants and hotels' is one solution. Potentially, however, it also is not without problems. EGMs are found in many (although not all) hotels and so there may be a high degree of correlation between expenditure in this category and expenditure on EGMs even though the figure for cafes/ restaurants and hotels excludes EGM revenue (the cafes/ restaurants and hotels category picks up mainly food and snack expenditure). A quick look at the correlation coefficient between these two groups shows, however, that there appears not to be a problem (the correlation is 0.0335) and so both categories of expenditure were included in the model.

The inclusion of dummy variables to capture the impact of the introduction of new gaming opportunities is rather crude in that it does not allow for the fact that the long run effect maybe different from the initial impact. It is, however, possible to measure the displacement effects more precisely given that we know the turnover from alternative gaming activities. Therefore the above model is rerun where G_{it} now represents the turnover from each form of gambling. This allows us to measure the average displacement effects over time. However, this specification raises a potential endogeneity problem. Turnover for each of the alternative gaming opportunities is potentially endogenous.

Given that consumers simultaneously decide how to allocate their expenditure across gaming activities, turnover of keno, say, is likely to be endogenous to lotto turnover, that is $\text{cov}(G_{it}, v_{it}) \neq 0$. However, we do have a potential instrument for turnover in each of the alternative gaming activities and this is the corresponding expenditure. Note that turnover is the amount bet regardless of the amount returned as winnings. For example, in the case of EGMs, turnover is the total amount paid into the machines, unadjusted for the amount that is returned as winnings. Expenditure, however, is the amount spent after winnings have been accounted for.

Turnover and expenditure differ in the gambling industry due to player losses but they are obviously highly correlated, which satisfies one criterion for a good instrument.

However it would be inappropriate to use expenditure as an instrument for turnover unless price (take-out) were exogenous. For most gambling media this is the case as the take-out rate it is set by a regulator or by legislation and is also a function of the tax imposed on the gaming activity. In the case of Australia, the taxation of gambling is a combination of federal and states taxes, adding interesting exogenous variation in expenditure relative to turnover across states. The average national gambling taxation in 1999-00 was AU$275 per capita. However, it was much higher in Victoria with a per capita tax of AU$385. Gambling taxes in 1999-00 were AU$4.4 billion, 2.2% of total taxation. Table 2 shows the breakdown of EGM prices and taxes by state as an example of the variation that is observed. For full tables revealing the full taxation differentials by gaming product across states, see Chapter 13, Productivity Commission (1999). It is clear that expenditure therefore differs from turnover due to exogenous variation in regulation and taxation and is therefore a suitable instrument for turnover.

It should also be noted that using a two-tail Pearson Correlation test, correlation was found between EGM expenditure and EGMs turnover at the 1% level of significance and no correlation was found between EGM expenditure and the error term in equation (1). This is also true for all the other gaming expenditure variables. We are, therefore, as content as one may be that they are suitable instruments for turnover. The final model is therefore estimated by two stage least squares (2SLS).

5. Results

The three specifications estimated are: first, a dummy variables specification that concentrates on the impact at the point of introduction of alternative gaming activities and assumes this to be constant from that point on; second, a specification that replaces the dummy variables with the respective level of turnover for the alternative forms of gaming; and finally, we perform an instrumental variable estimation, using expenditure to instrument turnover. The results are presented in Table3. The first thing to note is the relative performance of the three models. It is clear in terms of R^2 criteria that the dummy variables specification fits the data well; however, for reasons discussed below, we feel this model is misspecified. As we move from the turnover model to the final instrumental variables (IV) model, we see that the goodness of fit improves. The IV fits

the data best and is our preferred specification both on theoretical and empirical grounds. It is nevertheless interesting to compare the three sets of estimates.

The dummy variable estimates of the displacement effects report a very different story from the IV estimates. This is perhaps not too surprising as they are capturing different effects. The dummy variables are constructed to be zero until a gaming product is introduced and one thereafter. This assumes that the effect at the point of introduction is constant from that point forward in time. However this may not be the case. The initial impact in the first year say following the launch of a new gaming activity may be very different from the long term impact, say 10 years later. Removing the dummy variables and replacing them with the annual turnover for new gaming activities will capture these potential changes through time. The resultant estimate in this case tells us about the average displacement effects of new gaming activities.

One can see that the displacement effects from lotteries and minor gaming lose significance in the IV model and this is perhaps explained by the fact that they are the most likely endogenous gaming activities. The impact of EGMs is not picked up in the dummy variable specification but is significant in the other models. This is not surprising as EGMs exist in multiple small venues and these will have taken time to develop - so the growth of EGMs and any resultant impact on lotto is likely to occur gradually. Instant scratch cards, produced by the state lottery organisations, are not significant in any of the models: instants appear to grow the lottery market rather than cannibalise the on-line games. The IV results suggest that, in the case of other forms of gaming, there are negative displacement effects on lotto from the introduction of keno (which is significant in all specifications) and EGMs - with the quantitative effects from keno (-0.286) being larger than that from EGMs (-0.016). For ‘casinos’, however, the sign of the estimated coefficient is positive (+0.017) in the IV specification. This suggests, as in Walker’s (2000) US study, that growth in casino gaming reinforces growth in lotto sales. Such results are possible because a new product may cannibalise existing products (positive displacement) or promote them by spreading or deepening the taste for gambling as a generic activity (negative displacement).

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We find that turnover in Australian 'casinos' (which will include table and machine games) boosts rather than curtails sales of lotto and lotto-style products. Presumably this is because trips to these regional casinos advertise the idea of gambling to participants; but, for most people, access to a casino is not available on a weekly or daily basis, so that, after their trip, it is not an option to replace the regular purchase of lottery tickets with regular gaming in the casino. By contrast, increases in EGM turnover are shown by our results to be at the expense of lotto sales. Such cannibalisation is unsurprising. Putting money in machines or spending it at the lottery booth are clear alternatives because the EGM category refers to machines in hotels and clubs, in what outside Australia would be termed local casinos. At this level, machines and lotto tickets are clear alternatives: each is readily accessible and (given linking of machines[5]) each offers the possibility of a very substantial win.

Tobacco and alcohol expenditure were also included as a means of capturing differences in the degree of permissive attitudes across states and time and are found to have interesting coefficient estimates. In terms of our preferred IV model, that on tobacco expenditure is found to be negative and that on alcohol expenditure is found to be positive. These findings are therefore inconclusive if we view them as proxies for permissive attitudes to the group of products known as 'vices', and are even more confusing if we consider the locations in which they are sold. Tobacco is sold in retail outlets that are also allowed to sell lotto tickets and alcohol is sold at venues that are not licensed to sell lotto tickets. In this perspective, the results are contradictory to *a priori* expectations. Australia has a strong antismoking lobby and the negative coefficient on the smoking variable might be picking up a cultural shift away from smoking in general. Expenditure shares on tobacco have been declining steadily throughout this time period across all states[6].

[5] Linking of machines within venues is permitted in Victoria, NSW, Queensland, Australian Capital Territory (ACT) and Northern Territory. Externally linked machines operate in NSW, Queensland and ACT.

[6] We have estimated the model excluding the expenditure variables (tobacco, alcohol and café/restaurant/hotel expenditure) and the results are remarkably robust. These results are available from the authors on request. We choose to report the results with their inclusion as they suggest interesting avenues for further research.

In terms of the wider leisure industry, we find a positive impact on expenditure in cafes, restaurants and hotels only in the case of the dummy variable specification. The state fixed effects vary across the specification but make most sense in the context of the IV model. Here we find significant effects for New South Wales and Victoria, the two states which are known to be the most liberal in terms of gambling legislation. This suggests that the fixed effects, rather than the drinking and smoking variables, may be picking up the degree of permissiveness across states.

As regards the business cycle (looking at the IV model) we find no significant effect on lotto sales from the rate of unemployment or from disposable income; but there is a positive and significant time trend. Whilst the existing literature talks of lottery fatigue and a tendency for sales to fall through time, one should remember that lotto here refers to the total turnover from all on-line games and over the period under examination significant changes in the lotto market have occurred such as the establishment of the two large multi-state lotto games. This may explain the positive time trend in lotto turnover. One way to disentangle these effects would be to introduce into the model dummy variables which switch to one when the each state joined the multi-state games. The problem with this approach is that, given the nature of a multi-state game, most of the dummy variables will switch to one at the same time. Moreover, the analysis above has already shown the potential misspecification that arises through the inclusion of this type of dummy variable. In this case it is not possible to replace the dummy variables with the respective turnover as turnover for lotto is the dependent variable in the model. We therefore have allowed all of these effects to be absorbed by a time trend.

6. Conclusions

The literature on the relationship between different forms of gambling has often focused on ‘substitution’ and ‘complementarity’ between products. Often, however, these terms are misapplied because, following standard usage in economics, they should be reserved for referring to the issue of whether cross-price elasticities are positive or negative, not to the quite separate question of whether the introduction and spread of a new gambling medium cannibalises sales from existing media.

Here, we have focused on the latter question. Our case study has been of whether sales of lotto and lotto-style products in Australia were displaced by the introduction and growth of large casinos and by the spread of casino-style machine gaming within neighbourhood hotels (pubs) and clubs. Opposite results were found in the two cases. The emergence of the thirteen (super-) casinos appeared to reinforce the lotto market whereas machines in the network of local gaming venues diverted money away from lotto.

The results are of relevance to the policy debate in Great Britain where modern EGMs are to be permitted for the first time. Those forming the central product of a new 'regional' (super-) casino will pose no threat to National Lottery sales, according to indications from Australia. If there is only one regional casino in the country, which there will be for the time being, it will, even more so than for the thirteen in Australia, be remote from most of the population and the destination only for infrequent visits. Expenditure there is unlikely to displace weekly or twice-weekly lottery play. It would seem more likely that it would divert expenditure away from alternative tourist destinations for day or weekend trips (although this hypothesis has not been tested in this paper).

By contrast, Australian evidence suggests a potential for local casinos (of which there are now in Britain to be only eight new 'large' and eight new 'small') to divert significant sums from lotto and the causes it funds. An illustration of the possible size of impact may be obtained by extrapolating the regression results to suggest how much bigger lotto sales would be in the absence of EGMs in individual states. Consider, for example, South Australia, where EGMs in local venues were legalised in 1994. By 2002, per capita turnover for these machines had reached AU$4,503 (player losses AU$523). Per capita lotto turnover was AU$181: with the displacement effect we have estimated, lotto sales would be predicted to have been AU$72 higher in the absence of EGM expenditure, i.e. the lotto market appeared to be 28.4% lower in 2002 than it would have been without the introduction of EGMs. To take another example, Tasmania permitted EGMs from 1996. Both lotto and gaming machines attract lower

per capita sales than in South Australia but our estimate of the proportionate drop in lotto sales from introducing machines in Tasmania is of a similar order of magnitude (20.0%).

Local gaming venues in Australia, accessible and with 100-200 high prize machines, are just like those implied by the UK legislation authorising 'large' casinos. The original proposals in the Gambling Bill placed no limit on the number of these 'casinos in the community'. The severe restriction on their number by late variation of the terms of the new legislation represents a fortunate escape for the lottery and perhaps other gambling interests. But the process of reform may not yet have run its course. Our findings are relevant to an ongoing public debate.

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Figure 1: Real per capita lotto turnover by state ($m), 1982/83 – 2001/02

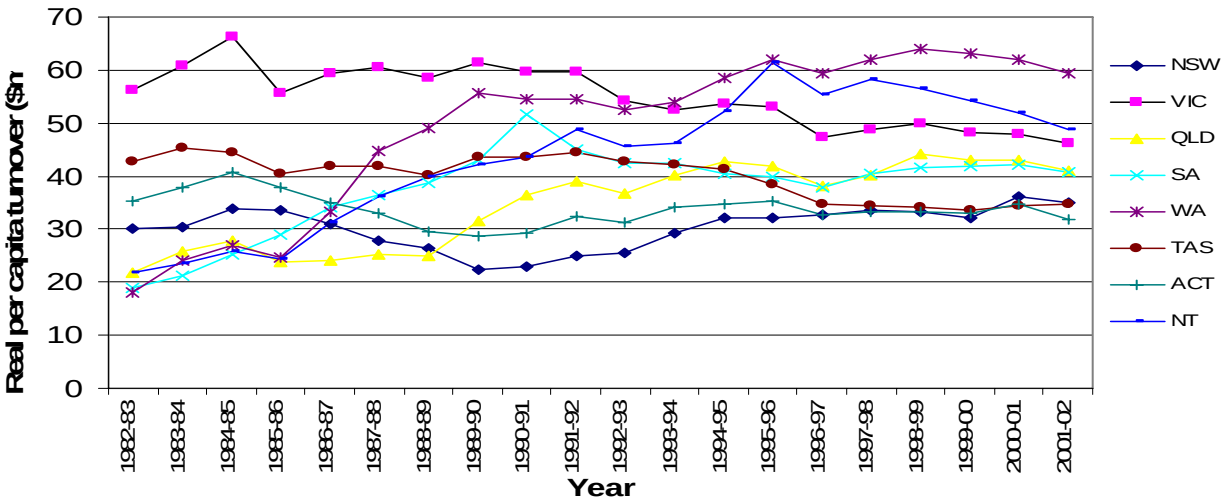

Table 1: The Legalisation of Gaming Activities across Australian States.

	Lotteries	Lotto	Instants	Casinos	Keno	EGM's
New South Wales (NSW)	1931	1979	1982	1995	Unknown	1956
Victoria (VIC)	1957	1972	1981	1994	1988	1990
Queensland (QLD)	1921	1979	Unknown	1985	Unknown	1991
South Australia (SA)	1966	1973	Unknown	1985	Unknown	1994
Western Australia (WA)	Unknown	Unknown	Unknown	1985	Illegal	Illegal
Tasmania (TAS)	Unknown	Unknown	Unknown	1973	Unknown	1996
Australian Capital Territory (ACT)	Unknown	Unknown	Unknown	1992	Unknown	1976
Northern Territory (NT)	1978	1978	1979	1997	Unknown	1990

Sources: Victorian Casino and Gaming Authority, 1999 and Department of Treasury and Finance, 2001.

Table 2: EGM's prices and taxes, 1997/98

1997/98	NSW	VIC	QLD	SA	TAS	ACT	NT
Turnover ($m)	30540	18098	4058	3292	207	1249	232
Expenditure ($m)	2989	1711	601	395	24	127	20
Tax ($m)	690	707	180	161	10	28	10
Player return	90.2%	90.5%	85.2%	88.0%	88.4%	89.8%	91.4%
Av tax rate	23%	41%	30%	41%	42%	22%	50%
Price per dollar	10c	9c	15c	11c	11c	10c	9c

Original Source: Australian Government (sub. D284, P.19) Reproduced from Productivity Commission (1999) "Australia's Gambling Industries" Report No 10, AusInfo, Canberra.

Table 3: Modelling Displacement Effects for Lotto Turnover - 1982/83 to 2001/02.

	Model 1- Dummy Variables Estimation			Model 2- Turnover Variables Estimation			Model 3- Instrumental Variables Estimation		
Variable	*Co-efficient*	*Standard Error*	*|t| statistic*	*Co-efficient*	*Standard Error*	*|t| statistic*	*Co-efficient*	*Standard Error*	*|t| statistic*
Lottery	**-7.689**	**(2.290)**	**3.36**	**-0.808**	**(0.317)**	**2.54**	-0.368	(0.407)	0.91
Instants	3.575	(4.897)	0.73	-0.244	(0.147)	1.67	-0.117	(0.156)	0.75
Casino	0.828	(1.908)	0.43	0.000	(0.003)	0.10	**0.017**	**(0.008)**	**2.02**
Minor gaming	**6.154**	**(1.570)**	**3.92**	**0.259**	**(0.080)**	**3.23**	0.082	(0.101)	0.82
Keno	**-4.941**	**(1.972)**	**2.51**	**-0.182**	**(0.077)**	**2.37**	**-0.286**	**(0.087)**	**3.30**
EGM's	0.626	(2.103)	0.30	**-0.011**	**(0.003)**	**4.30**	**-0.016**	**(0.003)**	**4.87**
Disposable income*	**-0.007**	**(0.003)**	**2.54**	**-0.005**	**(0.002)**	**2.18**	-0.003	(0.003)	1.33
Tobacco expenditure*	-0.118	(0.062)	1.89	-0.091	(0.062)	1.46	**-0.161**	**(0.068)**	**2.38**
Alcohol expenditure*	**0.217**	**(0.052)**	**4.15**	**0.154**	**(0.044)**	**3.47**	**0.103**	**(0.049)**	**2.12**
Cafe/restaurants/hotels expenditure*	**-0.039**	**(0.013)**	**3.02**	-0.017	(0.012)	1.38	0.008	(0.016)	0.53
unemployment rate	**-0.035**	**(0.014)**	**2.43**	-0.019	(0.013)	1.42	-0.012	(0.014)	0.84
NSW	-9.253	(5.494)	1.68	3.175	(5.734)	0.55	**17.542**	**(8.566)**	**2.05**
VIC	**13.978**	**(5.405)**	**2.59**	**13.763**	**(5.494)**	**2.51**	**27.991**	**(8.424)**	**3.32**
QU	**-9.748**	**(4.604)**	**2.12**	-7.846	(4.823)	1.63	1.801	(6.633)	0.27
SA	**-10.089**	**(4.496)**	**2.24**	-8.125	(5.287)	1.54	10.590	(9.315)	1.14
WA	-4.928	(4.793)	1.03	-1.087	(5.148)	0.21	9.450	(7.465)	1.27
TAS	-4.075	(4.159)	0.98	-6.327	(4.836)	1.31	8.003	(7.312)	1.09
ACT	-0.910	(9.669)	0.09	5.672	(8.716)	0.65	16.700	(11.131)	1.50
Time trend	**1.131**	**(0.369)**	**3.06**	**1.668**	**(0.285)**	**5.86**	**1.741**	**(0.295)**	**5.90**
Constant	**75.224**	**(13.080)**	**5.75**	**54.703**	**(14.392)**	**3.8**	30.594	(17.620)	1.74
R squared	0.984			0.760			0.788		
Adjusted R squared	0.986			0.728			0.760		

Note * indicates real per capita values. The omitted state is the Northern Territory